

552779

## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
28 October 2004 (28.10.2004)

PCT

(10) International Publication Number  
WO 2004/093324 A1

(51) International Patent Classification<sup>7</sup>: H03M 3/00

(21) International Application Number: PCT/IB2004/050424

(22) International Filing Date: 1 April 2004 (01.04.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
03101036.6 16 April 2003 (16.04.2003) EP

(71) Applicant (for all designated States except US): KONINKLIJKE PHILIPS ELECTRONICS N.V. [NL/NL];  
Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and  
(75) Inventors/Applicants (for US only): JANSSEN, Erwin

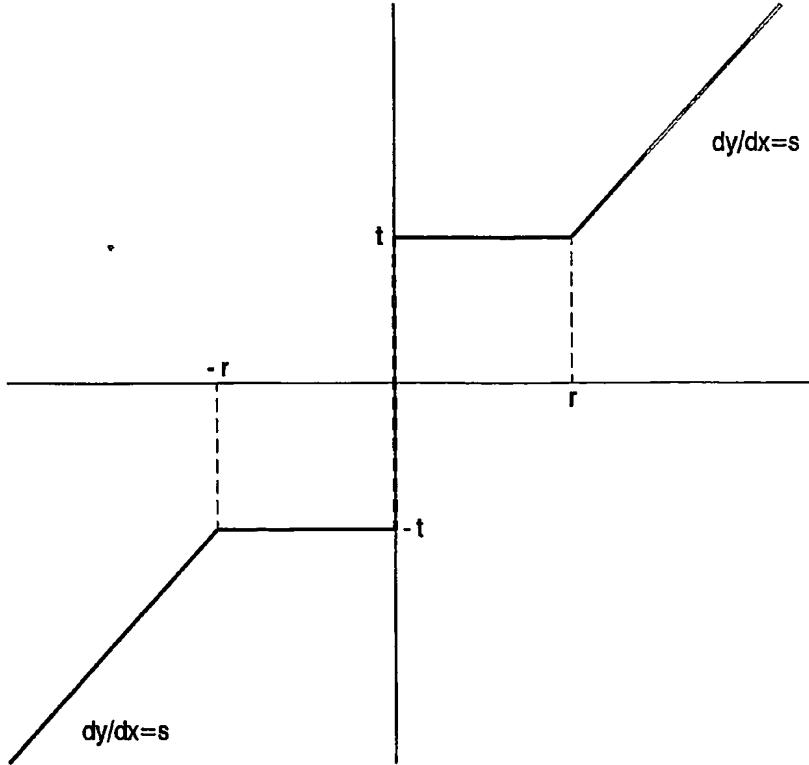
(74) Agent: ELEVLD, Koop, J.; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

[Continued on next page]

(54) Title: SIGMA-DELTA MODULATOR



(57) Abstract: A sigma-delta modulator (SDM) including  $n$  ( $n > 1$ ) integrators in series, where a first of the  $n$  integrators receiving an input signal, at least one Q device, which acts as a quantizer when an absolute value of a signal input thereto is smaller and as a gain element (either with or without offset) when the absolute value of the signal input thereto is larger, and a device for quantizing an output of the unit. The SDM may be a feed back or feed forward SDM. The SDM may include a single or multiple Q devices. The single Q device may be positioned so that the signal input to the one Q device is an output of the last integrator and the output of the one device  $Q_1$  is input to the device for quantizing and/or to the  $n$  integrators. For multiple Q devices, each of the Q devices may have different parameters set to improve stability, improve SNR, and/or reduce introduction of artifacts. The SDM may be part of an analog to digital converter and/or a digital to digital converter. The SDM may process digital or analog signals, for example, a 1-bit signal.

WO 2004/093324 A1



Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Published:**

— *with international search report*